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NATIONAL MARINE FISHERIES SERVICE

Alaska Fisheries Science Center
Resource Assessment & Conservation
Engineering Division
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CRUISE RESULTS SUPPLEMENT

Cruise 91-1 Ocean Hope 3

1991 Eastern Bering Sea Juvenile Red King Crab Survey

May 24 - June 3, 1991

INTRODUCTION

A trawl survey is conducted each summer in the eastern Bering Sea (EBS) by the Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) to provide data on populations of commercially important fishes and invertebrates. Adults and large juveniles of many species are well sampled while smaller juveniles of most species are not. Prior to the standard EBS survey (for which a seperate Cruise Results document is available), a ten day survey was conducted between May 24 and June 3, 1991 in Bristol Bay waters to find potential long-term monitoring sites for juvenile red king crabs and to make observations of juvenile red king crab and selected juvenile fish species. Data were collected on the abundance and size composition of red king crab, halibut (both of which are prohibited bycatch species) and other fish at 28 pre-selected locations. These data might allow improved estimates of total population for analysis of bycatch rates.

Sites were selected for the placement of three temperature recording devices based in part on the distribution of crab in this survey. These devices were deployed at the beginning of the first leg of the R/V Alaska cruise that immediately followed this cruise.

OBJECTIVES

The primary objectives of this survey were to:

1. Determine the distribution and relative abundance of juvenile red king crab and juvenile flatfish in inshore waters that are largely shoreward from the area covered by the annual eastern Bering Sea trawl survey,

2. Identify microhabitats occupied by juvenile red king crab (<50 mm carapace length) to the extent that this is possible with a trawl,

3. Select sites for the deployment of three continuous temperature recording devices in the inshore areas in which we found concentrations of juvenile crabs.

VESSEL AND GEAR

The survey was conducted aboard the 33 m chartered trawler Ocean Hope 3. Two standard gears were used:

1. A 10 ft by 2 ft rigid frame beam trawl weighing 380 lbs (Appendix 1). The net was constructed of 1.25 inch stretch mesh web had a 0.5 inch stretch mesh codend liner. The headrope of the net was secured to the top pipe of the beam in six places, and the footrope was weighted with 5/8" chain and secured at its wing tips to the outboard eyes on the ends of the beam. A 10' tickler of 5/16" chain was attached to the inboard eyes at the ends of the beam. The 30' long bridles were 5/8" 6 x 19 wire rope with thimbled eyes at both ends.

2. A 4 x 2 ft scallop dredge fitted with 0.5 inch stretch mesh liner.

ITINERARY

The Ocean Hope 3 departed Dutch Harbor on May 24 and began sampling on May 26. Sampling was completed on June 1 and the vessel returned to Dutch Harbor on June 3. No days were lost to weather or equipment failure.

SURVEY DESIGN AND METHODS

Sampling sites were chosen based on the location of directed and incidental catches of red king crab less than 51 mm carapace length (cl) from past NMFS surveys and other sources. Seven transects were sampled between Port Moller and Kvichak Bay (Fig. 1). Water depths range from 6 to 37 fm (Fig. 2). The sample pattern was developed on the assumption that the vessel could make 12 fifteen minute tows in a relatively small area every 24 hours. At each sampling site, the vessel made two tows at each of four stations about 5 mi apart during the day. In the evening, the vessel doubled back and made one "night" tow (after 2200 hrs) at each of the four stations. The seven transects were close enough together that little sampling time was lost getting from one site to the next.

The beam trawl was intended to be the primary gear, with the scallop dredge fished only where the bottom was too rough for the beam trawl. The standard tow was fifteen minutes in duration. The gear was fished from the left trawl warp with a scope of 3:1. When the beam trawl was brought to the surface, a cable that ran through a block in the middle of the A-frame was attached to an eye in the middle of the beam. That cable was taken up, bringing the beam into a horizontal position up against the A-frame. The codend was then brought aboard and its contents dumped on a sorting table near the stern. The catch was sorted, major taxa were identified and general quantities recorded. Carapace lengths of red king crab were measured and juvenile flatfish were collected for further study. Red king crab less than 10 mm cl were returned to the Kodiak Lab for measuring and examination.

The temperature recording devices that were deployed on the first leg of the R/V Alaska cruise that immediately followed this cruise were place at the following locations:

Unit # 902741	Port Moller - 56° 25.46' N,	160° 13.05' W
Unit # 902743	Port Heiden - 56° 59.96' N,	159° 10.31' W
Unit # 902742	Kvichak Bay - 58° 07.19' N,	158° 02.76' W

RESULTS

Seventy seven tows were completed during the survey, 75 of which were with the beam trawl (Table 1). The beam trawl was the only gear deployed at transects A through F. At transect G, where the bottom was made up of cobble and boulders, both gears were fished with very limited success. Bottom water temperatures ranged from 2.6 to 8.6°C (Table 1, Fig. 3).

A total of 167 red king crabs (RKC) was caught during the survey (Table 1). Small RKC <15 mm were found at 8 stations on transects C, D, E, and F (Figs. 4 and 7). Medium RKC (15-49 mm) were found at 8 stations on transects C, D, F, and G (Figs. 5 and 7). Crabs >49 mm were found at 12 stations on transects A, B, C, E, and F (Figs. 6 and 8). Generally, the majority of large RKC (>49 mm) were found west of Port Moller, whereas all RKC <50 mm cl were found on transects east of Port Moller. We found small RKC at virtually every location where we hoped to find them except in Kvichak Bay (Transect G) where the bottom was essentially not samplable.

Crabs in the size range 4-11 mm cl appeared to be the 1990 yearclass, and many of them were found associated with a biological substrate, as follows:

1. embedded among strands of mussels (Transect C).
2. attached to bryozoans and/or hydroids at the bases of sea onion, Boltenia ovifera stalks (Transect E).
3. among clumps of polychaete tubes (Transect D).

4. in tows where Asterias and Evasterias were abundant, but not attached to them (Transects C and D).

Very few crabs <15 mm cl were found loose in the catch.

There was a strong segregation between small/medium (<50 mm) and large (>49 mm) crabs. Crabs <50 mm did not occur at stations where large crabs were caught, and vice versa. The mean depth of small crabs was shallower than that of large crabs (Table 2).

Catch rates (crabs/mile towed) were compared between day and night tows, by parametric Anova and nonparametric tests (Mann-Whitney U, Median test, Kolmogorov-Smirnov, and Kruskal-Wallis oneway nonparametric Anova) Although small crab seemed to be more abundant in daytime tows (Fig. 9), no significant differences were found in any of these tests (Table 3). The difference in day/night abundance of small crab may have occurred because it was easier to see them on the sorting table in the daytime.

We feel that the beam trawl has a high potential for use in indexing the abundance of very small red king crab, and that they probably exist at a wide variety of locations. Further studies should use a more systematic spacing of stations, and examine the statistical relationship between the abundance of small RKC and Boltenia/hydroid/bryozoan assemblages.

No data are currently available on the distribution, abundance, or size frequency of juvenile fish caught during the cruise.

SCIENTIFIC PERSONNEL

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Table 1. Haul and catch data for the 1991 eastern Bering Sea juvenile red king crab survey.

HAUL	STA	DATE MO	DA	START POSITION LAT	LONG	DEP FMS	HR	DURAT HRS	DIST TOWD	TEMP DG C	CRAB/SIZE GP SMA	MED	LAR
1	A11	5	26	5600.16	16121.90	12	10	0.25	1.02	4.3	0	0	0
2	A12	5	26	5600.93	16120.76	13	11	0.25	0.96	4.3	0	0	0
3	A21	5	26	5604.23	16121.86	19	12	0.25	0.91	4.0	0	0	0
4	A22	5	26	5604.67	16122.26	19	12	0.25	0.92	4.0	0	0	1
5	A31	5	26	5608.23	16128.99	26	14	0.25	0.96	3.6	0	0	12
6	A32	5	26	5607.93	16130.67	26	14	0.25	0.74	3.6	0	0	9
7	A41	5	26	5611.79	16132.22	29	15	0.25	0.98	3.4	0	0	8
8	A42	5	26	5612.05	16133.09	30	15	0.25	0.77	3.4	0	0	9
9	A43	5	26	5613.82	16132.76	32	22	0.25	0.93		0	0	9
10	A33	5	26	5608.28	16129.03	26	23	0.25	1.13		0	0	2
11	A23	5	26	5604.38	16124.70	19	24	0.25	1.10		0	0	2
12	A13	5	27	5600.69	16121.23	13	1	0.25	1.33		0	0	0
13	B11	5	27	5616.79	16054.55	22	10	0.25	0.66	4.0	0	0	0
14	B12	5	27	5616.10	16054.39	23	10	0.25	1.10	4.0	0	0	5
15	B21	5	27	5621.45	16100.86	30	11	0.25	1.04	4.0	0	0	0
16	B22	5	27	5622.68	16102.62	31	12	0.25	0.85	4.0	0	0	1
17	B31	5	27	5625.88	16106.12	34	13	0.25	0.83	3.1	0	0	14
18	B32	5	27	5626.74	16106.26	34	14	0.25	1.01	3.1	0	0	6
19	B41	5	27	5631.27	16112.29	37	15	0.25	0.78	3.1	0	0	0
20	B42	5	27	5630.51	16112.35	37	15	0.25	0.98	3.1	0	0	9
21	B43	5	27	5629.51	16111.19	38	22	0.25	0.92		0	0	7
22	B33	5	27	5625.91	16105.32	35	23	0.25	0.96		0	0	0
23	B23	5	27	5621.85	16059.99	31	23	0.25	0.88		0	0	1
24	B13	5	27	5617.14	16055.90	27	24	0.25	0.93		0	0	1
25	C11	5	28	5624.93	16012.03	11	10	0.25	0.82	4.8	11	2	1
26	C12	5	28	5626.61	16010.97	12	11	0.08	0.21	4.8	2	0	0
27	C21	5	28	5628.22	16014.20	15	11	0.25	0.73	4.5	1	0	0
28	C22	5	28	5627.63	16015.79	14	12	0.25	0.67	4.5	0	0	0
29	C31	5	28	5631.50	16018.49	22	13	0.25	0.79	3.7	0	1	0
30	C32	5	28	5632.00	16019.62	22	14	0.25	0.78	3.7	0	0	0
31	C41	5	28	5634.59	16022.75	26	15	0.25	1.13	3.6	0	0	0
32	C42	5	28	5633.25	16023.24	26	15	0.25	0.87	3.6	0	0	0
33	C43	5	28	5634.30	16024.02	27	21	0.25	0.78		0	0	0
34	C33	5	28	5631.04	16019.37	20	22	0.25	0.99		0	0	0
35	C23	5	28	5628.46	16014.20	14	23	0.25	0.87		2	0	0
36	C13	5	28	5625.33	16010.76	13	23	0.25	0.89		0	0	0
37	D11	5	29	5657.57	15916.03	22	10	0.25	0.88	3.7	1	0	0
38	D12	5	29	5658.34	15914.99	21	10	0.25	0.92	3.7	1	0	0
39	D21	5	29	5658.64	15908.07	16	11	0.25	0.90	4.2	7	8	0
40	D22	5	29	5659.36	15906.47	17	12	0.25	1.07	4.2	1	0	0
41	D31	5	29	5700.27	15859.58	14	12	0.25	0.90	4.2	0	0	0
42	D32	5	29	5701.08	15857.06	14	13	0.25	0.67	4.2	2	0	0
43	D41	5	29	5700.65	15850.89	11	14	0.25	0.74	4.5	0	0	0
44	D42	5	29	5701.21	15850.82	11	14	0.25	0.72	4.5	0	0	0
45	D43	5	29	5700.53	15850.47	21	21	0.25	0.65		0	0	0

Table 1. (Continued)

HAUL	STA	DATE MO	DA	START POSITION LAT	LONG	DEP FMS	HR	DURAT HRS	DIST TOWD	TEMP DG C	CRAB/SIZE GP SMA	MED	LAR
46	D33	5	29	5659.81	15858.42	24	22	0.25	0.55		1	1	0
47	D23	5	29	5659.81	15858.42	31	23	0.25	0.55		1	0	0
48	D13	5	29	5658.45	15913.42	37	24	0.25	0.50		0	1	0
49	E11	5	30	5721.70	15858.15	26	10	0.25	0.76	2.8	0	0	0
50	E12	5	30	5722.47	15858.33	26	11	0.25	0.75	2.8	0	0	0
51	E21	5	30	5726.52	15901.36	28	12	0.25	0.71	2.8	0	0	0
52	E22	5	30	5727.21	15901.96	28	12	0.25	0.90	2.8	0	0	0
53	E31	5	30	5730.55	15905.38	27	13	0.25	0.76	2.7	2	0	0
54	E32	5	30	5731.46	15906.37	27	13	0.25	0.83	2.7	1	0	0
55	E41	5	30	5735.62	15909.90	28	15	0.25	0.77	2.6	2	0	0
56	E42	5	30	5736.22	15910.83	29	15	0.25	0.83	2.6	0	0	0
57	E43	5	30	5735.41	15909.42	26	21	0.25	0.56		0	0	6
58	E33	5	30	5731.36	15905.67	25	22	0.25	0.85		0	0	0
59	E23	5	30	5727.11	15901.39	27	23	0.25	0.90		0	0	2
60	E13	5	30	5722.57	15856.90	25	24	0.25	0.85		0	0	2
61	G11	5	31	5824.90	15749.49	10	13	0.25	0.78		0	1	0
62*	G21	5	31	5829.12	15742.13	11	14	0.08	0.36		0	0	0
63*	G31	5	31	5833.13	15740.25	6	15	0.08	0.51		0	0	0
64	G32	5	31	5833.74	15735.39	6	16	0.17	0.21	8.1	0	0	0
65	G41	5	31	5837.88	15726.21	11	17	0.25	1.22	8.6	0	0	0
66	F41	5	31	5809.39	15758.77	15	22	0.25	0.83		0	3	0
67	F31	5	31	5805.28	15806.36	18	23	0.25	0.71		0	2	0
68	F21	5	31	5802.30	15811.62	18	24	0.25	0.62		0	0	0
69	F11	5	31	5800.32	15816.45	20	24	0.25	0.51		0	0	0
70	F42	6	1	5807.89	15759.00	15	10	0.25	0.61	4.8	1	0	0
71	F43	6	1	5808.21	15800.36	16	10	0.25	0.95	4.8	0	0	0
72	F32	6	1	5806.14	15805.66	19	11	0.25	1.05	4.5	0	3	0
73	F33	6	1	5805.44	15805.11	19	12	0.25	0.87	4.5	0	1	1
74	F22	6	1	5802.80	15812.75	18	13	0.25	0.84	3.8	0	0	0
75	F23	6	1	5802.41	15814.93	19	13	0.25	0.92	3.8	0	0	0
76	F12	6	1	5759.56	15819.47	19	14	0.25	0.86	3.7	0	0	0
77	F13	6	1	5759.77	15818.04	19	14	0.25	0.62	3.7	0	0	0
									TOTAL CRAB CAUGHT		36	23	108

* = modified scallop dredge tow

Table 2. Mean depth (fathoms) of crabs by size group. Small = 4-14 mm; Medium = 15-49 mm; Large >49 mm. Mean depths were computed for tows, and weighted by number of crabs caught.

	Mean Depth in Fathoms		
Weighting	Small	Medium	Large
By Tow	17	17	30
By Crab	20	19	27

Table 3. Probability values for statistics comparing catch per mile towed by day vs night for red king crab from inshore stations. Cochrans C and Bartlett-Box F test for homogeneity of variance.

SIZE GROUP	COCHRANS C	BARTLETT -BOX F	NORMAL ANOVA F	MEDIAN TEST CHI-SQ	MANN-WHITNEY U	KOLMOG-SMIRNOV Z	KRUSKAL-WALLIS F
SMALL	0.000	0.000	0.231	0.356	0.226	0.964	0.226
MEDIUM	0.108	0.155	0.770	0.706	0.442	0.995	0.442
LARGE	0.166	0.218	0.985	0.409	0.396	0.964	0.396
ALLRK	0.004	0.013	0.607	0.453	0.657	0.491	0.657
LT50	0.000	0.000	0.451	0.783	0.732	0.995	0.732
GT50	0.096	0.141	0.938	0.104	0.204	0.370	0.204

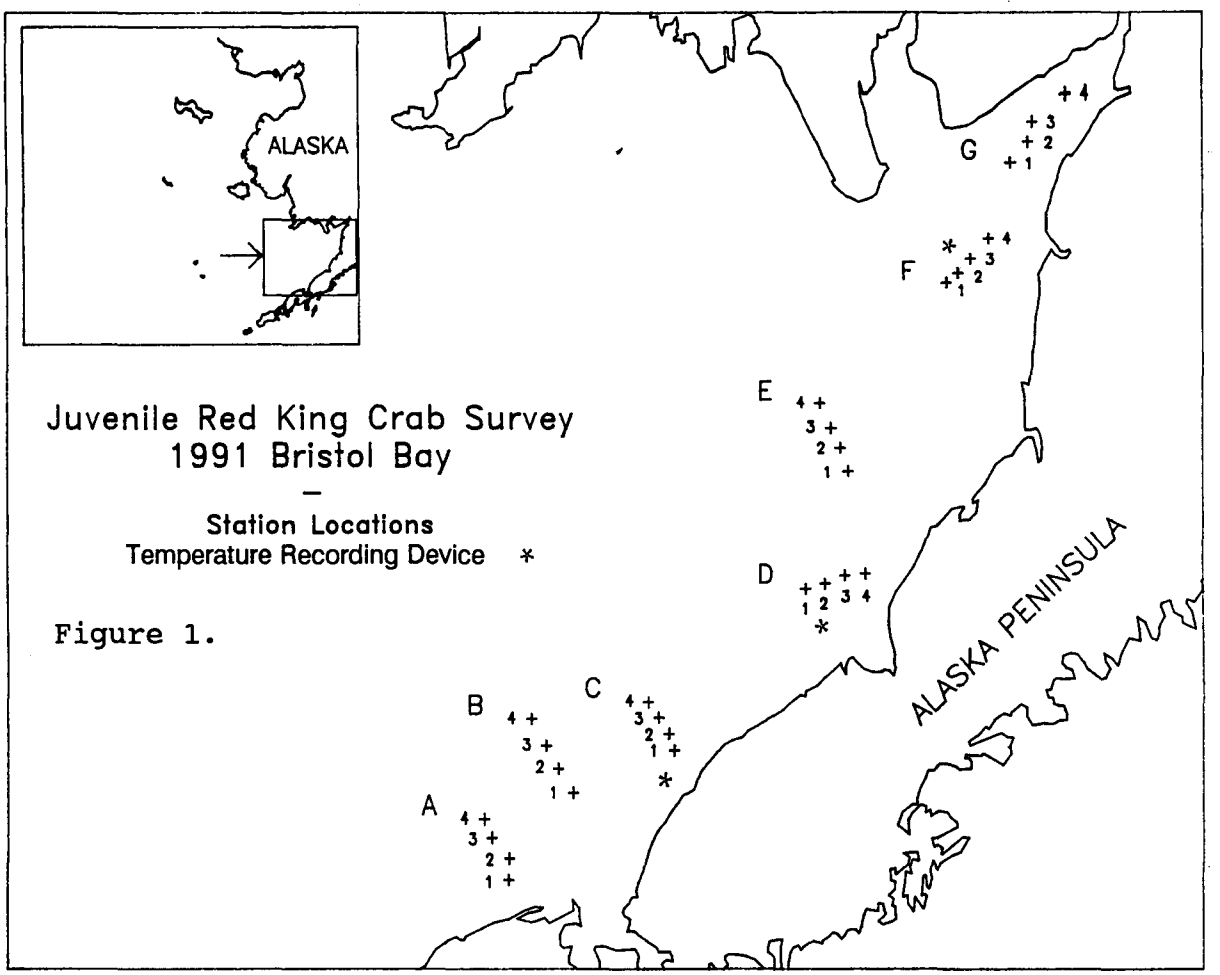


Figure 1.

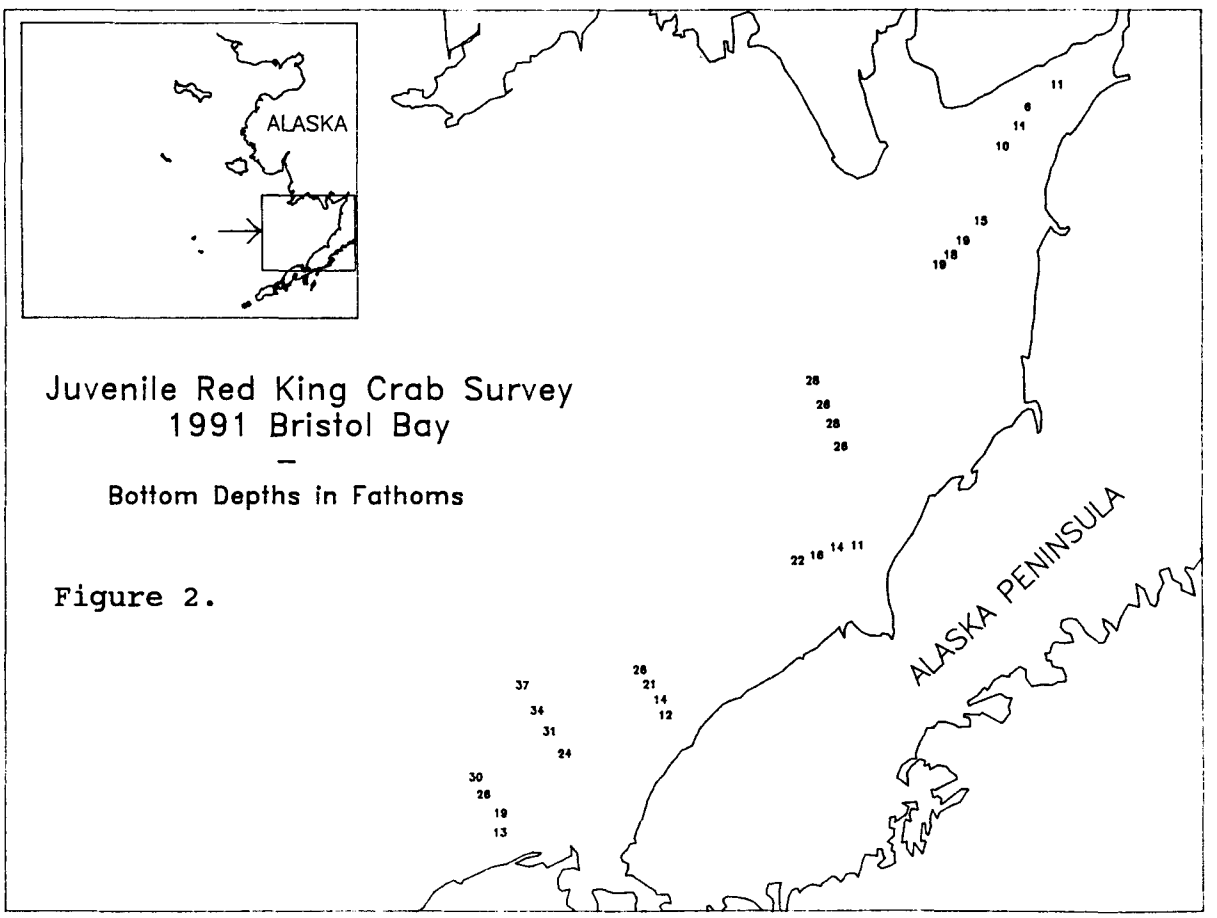
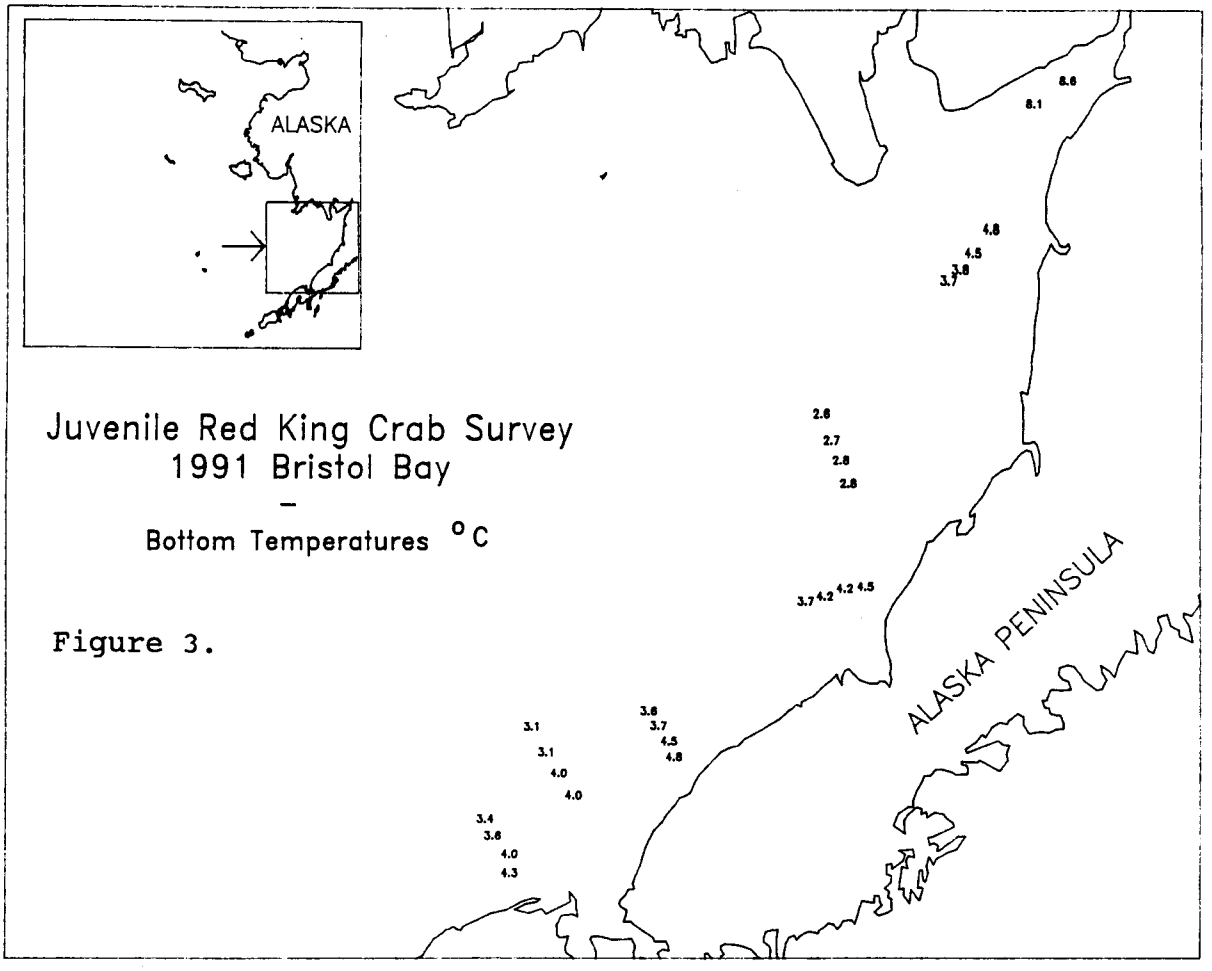


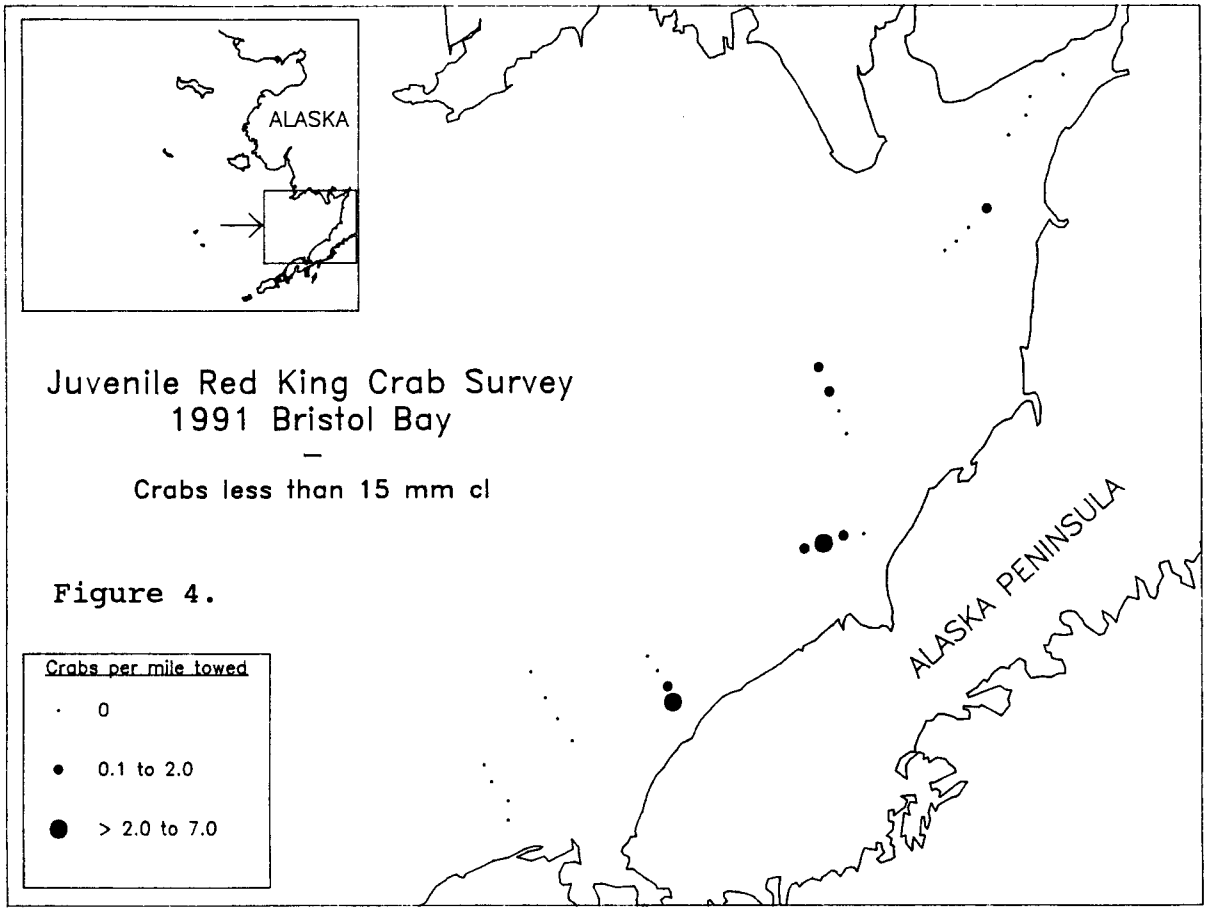
Figure 2.



Juvenile Red King Crab Survey
1991 Bristol Bay

Bottom Temperatures °C

Figure 3.



Juvenile Red King Crab Survey
1991 Bristol Bay

Crabs less than 15 mm cl

Figure 4.

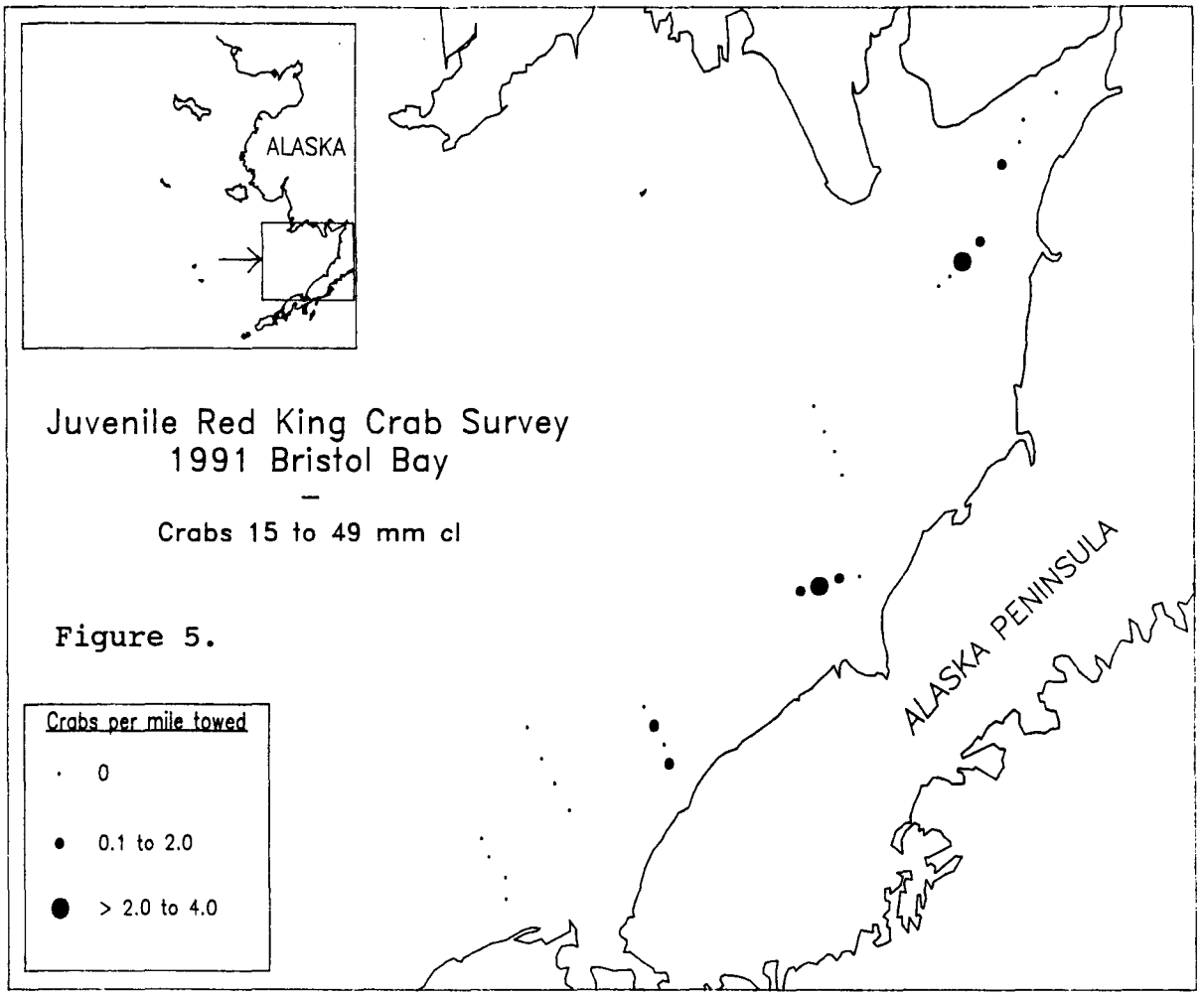


Figure 5.

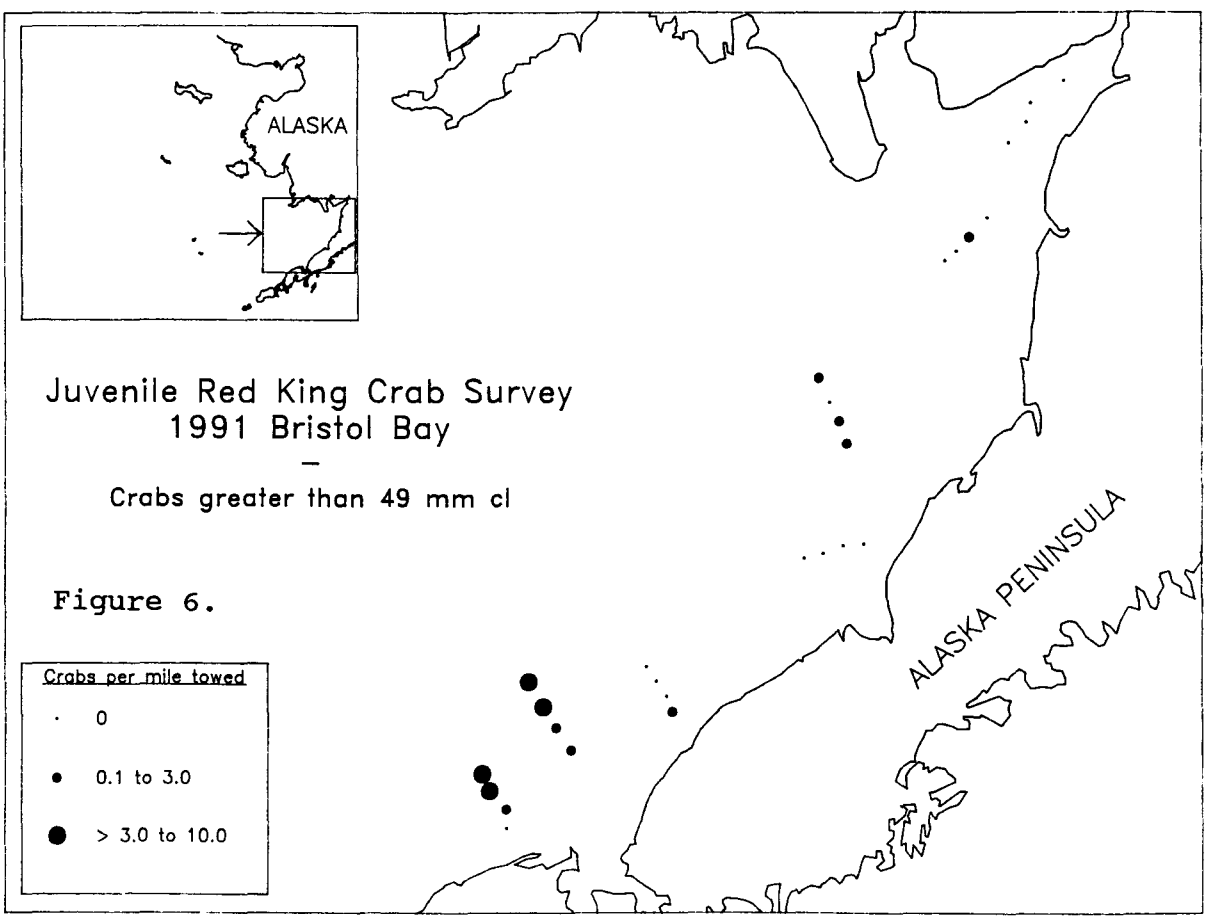


Figure 6.

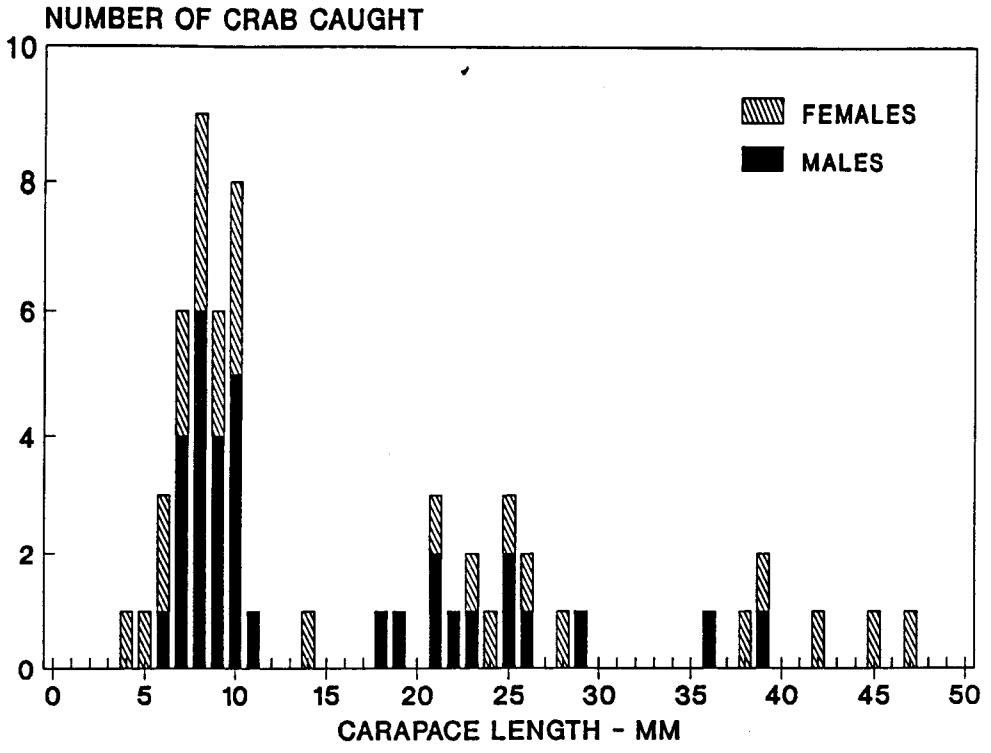


Figure 7. Length frequency of small (less than 50 mm) red king crab caught in the 1991 eastern Bering Sea juvenile survey.

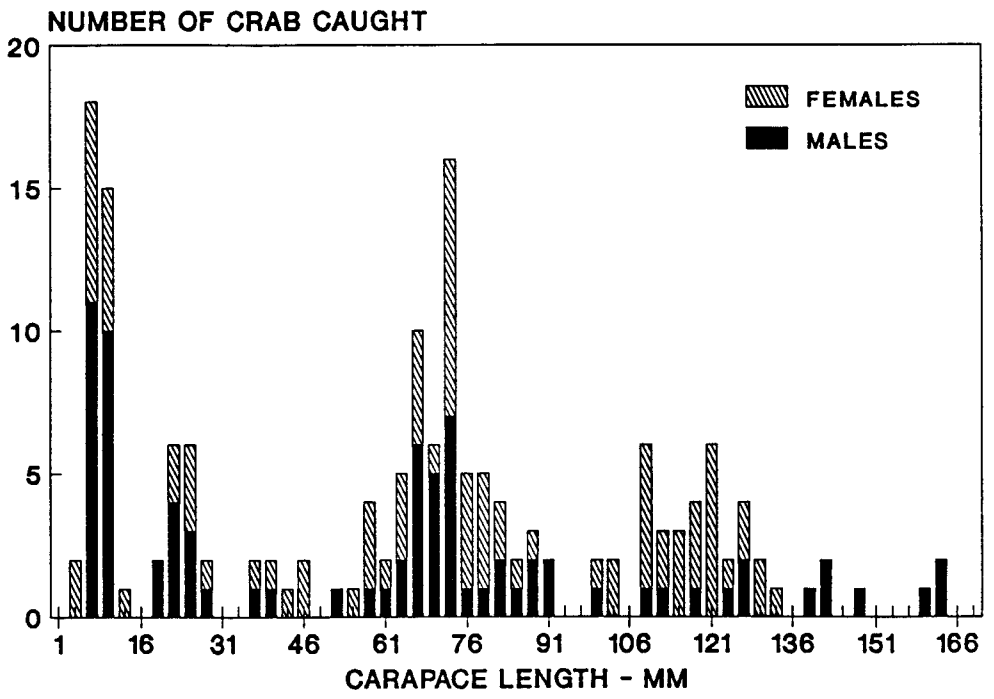


Figure 8. Length frequency of all red king crab caught in the 1991 eastern Bering Sea juvenile survey.

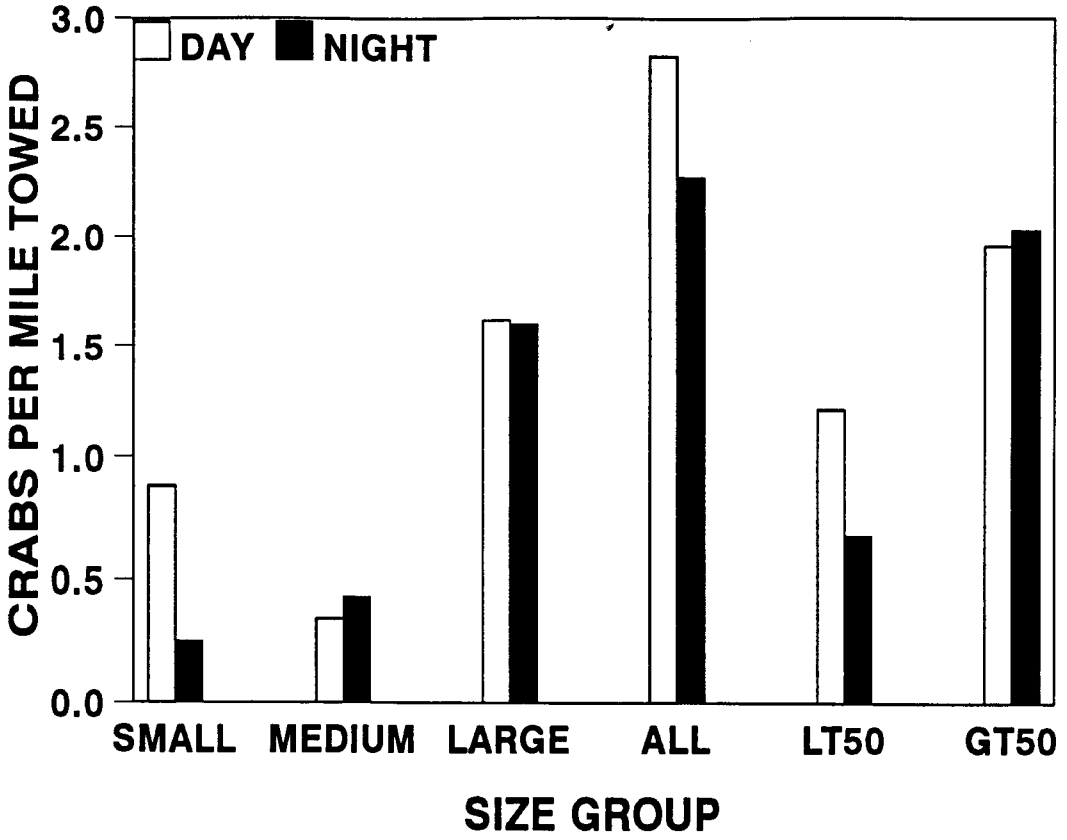


Figure 9. Mean red king crab CPUE (crabs/mile towed) for day vs. night tows. No differences were significant.

Appendix 1